

3D Printed Composite-Z and Graded-Z Radiation Shields (CoGZ-Rad), Phase I

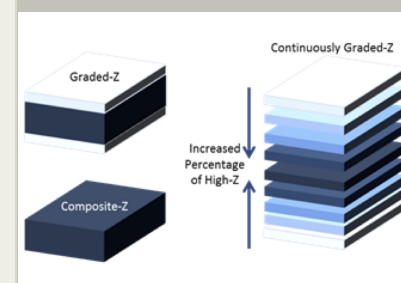
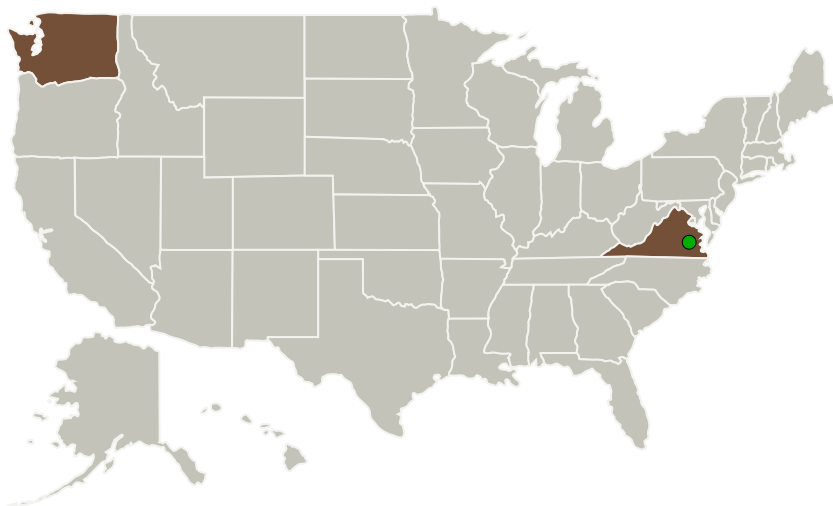
Completed Technology Project (2016 - 2016)



Project Introduction

Composite-Z and Graded-Z Radiation Shields (CoGZ-Rad) uses novel multi-material 3D printing techniques to fabricate a cost-effective and lightweight radiation shielding comprised of polymers and polymer composites. CoGZ-Rad relies on advancing the concept of the graded-atomic number (graded-Z) radiation shielding by utilizing new materials and materials configurations to form graded-Z, composite-Z, and compositionally graded-Z radiation shields utilizing lightweight and low cost polymers to increase the lifetime of COTS electronics in the space environment. Printing for the CoGZ-Rad effort requires a novel additive manufacturing technique in the form of multimaterial 3D printing through a single 3D printer nozzle which assists in materials mixing and the dilution of the composite 3D printer feedstock. This will allow for any of the materials configurations to be printed without a large number of materials or printer feedheads to be required. In addition to the 3D printing advancements, we will also be building a physics design tool to assess shield performance with respect to single event effects and single event upset. In Phase I, we will demonstrate the feasibility of CoGZ-Rad as a radiation shield through laboratory fabrication and testing. In phase II, we will demonstrate flight qualification of the technology to TRL-6.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Tethers Unlimited Inc	Lead Organization	Industry	
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Virginia	Washington

Project Transitions

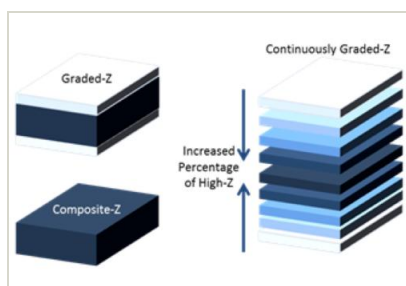
▶ **June 2016:** Project Start

✓ **December 2016:** Closed out

Closeout Documentation:

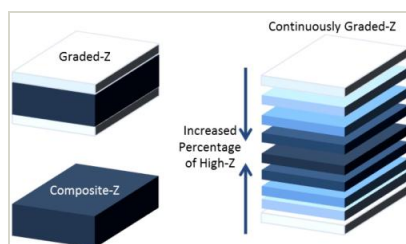
- Final Summary Chart(<https://techport.nasa.gov/file/139683>)

Images



Briefing Chart Image

3D Printed Composite-Z and Graded-Z Radiation Shields (CoGZ-Rad), Phase I
(<https://techport.nasa.gov/image/131315>)



Final Summary Chart Image

3D Printed Composite-Z and Graded-Z Radiation Shields (CoGZ-Rad), Phase I Project Image
(<https://techport.nasa.gov/image/134711>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Tethers Unlimited Inc

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

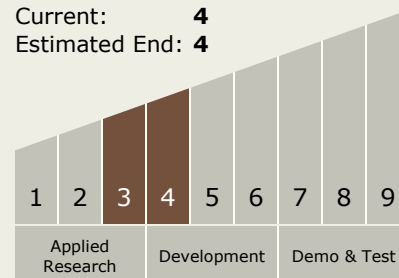
Carlos Torrez

Principal Investigator:

Rachel Muhlbauer

Technology Maturity (TRL)

Start: 3
Current: 4
Estimated End: 4



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Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
 - └ TX06.5 Radiation
 - └ TX06.5.3 Protection Systems

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System